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Systematics and Ecology of Benthic Phyllodocidae (Annelida: Polychaeta) off the Columbia River, U.S.A.

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Abstract.—The benthic phyllodocid polychaete fauna of the continental shelf off the Columbia River, northern Oregon, and southern Washington, at depths of 11 to 97 m, is reported. Three species of *Eteone* and one species of *Anaitides* are newly described. *Eteone* (*Mysta*) *barbata* is newly reported in the Northeast Pacific Ocean. Ranges are extended for *Eteone longa*, *Anaitides hartmanae* and *Anaitides longipes*, the latter two species new to Oregon and Washington; *E. longa* is new to Oregon. New records are given for *Eteone californica* and *Eulalia levicornuta*. The local distribution, including depths and sediment type(s), of each species is summarized. The distributions of all species in the genus *Anaitides* overlapped, while those of some species in *Eteone* were relatively segregated. The occurrence of *E. longa* following the dumping of dredged sediments from the Columbia River mouth is discussed.

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Phyllodocids are active, mainly benthic, polychaetes which are often brilliantly colored in life. The systematics and phylogenetic relationships within the family Phyllodocidae, as well as the geographical distributions of species in the polar basin and the Northwest Pacific Ocean, were treated by Ushakov (1972). Phyllodocid polychaetes have been reported from the Northeast Pacific Ocean off California by a number of workers, most notably Hartman (1936, 1968), and off Oregon and Washington by Carey (1972), Hartman and Reish (1950), Fauchald and Hancock (in press), Banse and Hobson (1974), and Richardson et al. (1977—a Final Report to the U.S. Army Corps of Engineers). Of these, only Richardson et al. (1977) dealt with the area off the mouth of the Columbia River. Richardson et al. (1977), making use of species identifications in all the major phyla, defined the benthic invertebrate assemblages in a 435 square km area extending from northern Oregon to southern Washington (Fig. 1). Of the 38 polychaete families represented in this area, the family Phyllodocidae was the most speciose, containing 14 species. The present paper discusses the systematics and ecology of those species. Other polychaetes off the Columbia River will be treated in a forthcoming paper.

Methods

1,665 quantitative samples were taken at 119 stations off the Columbia River from December 1974 through June 1976 using a 0.1 m^2 Smith-McIntyre grab on board the R/V *Cayuse*. Locations of stations are shown in Fig. 1 and the cruises during which they were sampled are listed in Table 1. Six replicate grab samples

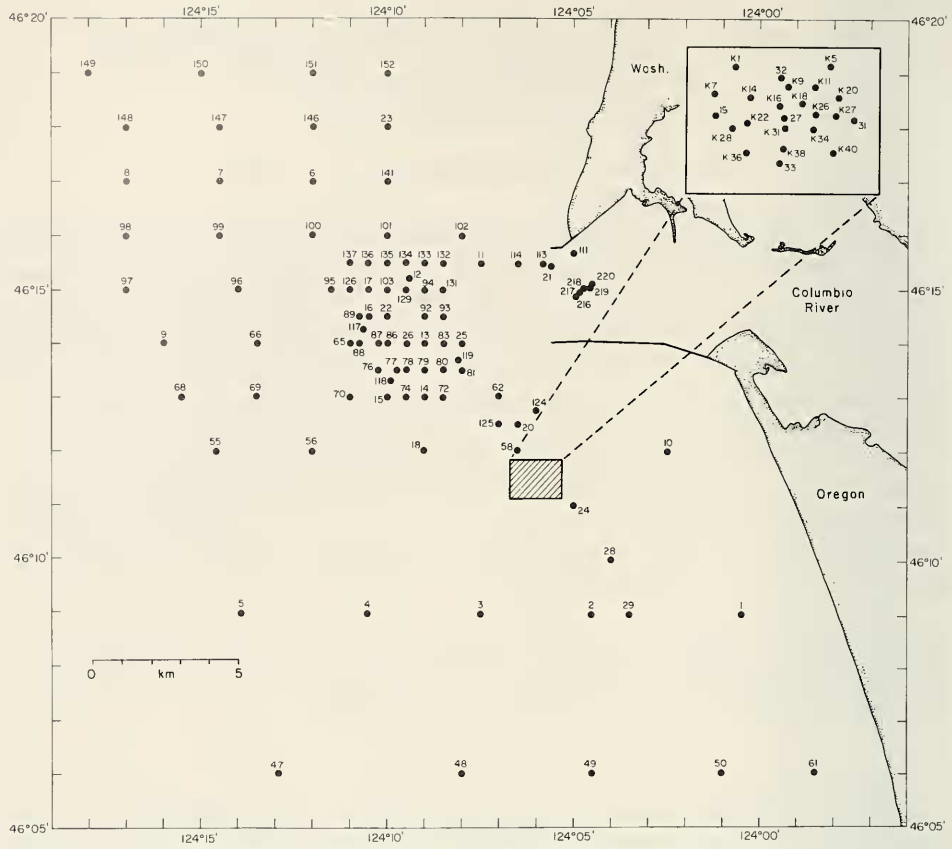

Fig. 1. Station locations off the Columbia River.

were obtained at each station during each cruise that the station was sampled. Two sets of six replicate grab samples were obtained at stations 14, 25 and 26 during cruise A. Of each set of six replicate grab samples, five were sieved through a 1 mm mesh screen, the polychaetes retained on the screen preserved in 10% Formalin and identified, and one was used for sediment analysis. In replicate sets 16E, 17E, 24D, 29D, 47A, 217D, K20E and K38E, polychaetes were identified from four rather than five samples. In 7B, 7C, 7D, 7E, 7G, 8B, 8C, 8D, 8E, 8G, 96A, 97A, 98A, 99A, 148B, 149B and 150B, polychaetes were identified from only three samples. Twenty-one grabs were taken at station 19 during cruise A, polychaetes identified from 20 of them. From cruise C onward, one grab of every replicate set was screened through a 0.5 mm screen and later divided into 1 mm and 0.5 mm fractions. Though a number of phyllodocid polychaetes in the 0.5 mm fractions were too small to be identified to the species level, none appeared to differ at the species level from those encountered in the 1 mm samples. Specimens in the 0.5 mm fractions are not reported herein.

Study Area

The major feature in the study area (Fig. 1) is the Columbia River, the largest river on the Pacific coast of North America. The Columbia River plume is delim-

Table 1. Sampling dates (cruises) of stations off the Columbia River.

Stations	Cruises[1] A 4–8 Dec. 1974	B 19–25 Jan. 1975	C 19–21 April 1975	D 23–27 June 1975	E 12–15 Sept. 1975	F 21–22 Oct. 1975	G 5–9 Jan. 1976	H 19–20 April 1976	I 7–8 June 1976
13, 25, 26	x		x	x	x				
11, 21		x	x	x	x				
1–5, 10, 14–16, 22	x		x	x	x		x		
6–8, 12, 17, 23		x	x	x	x		x		
18, 19	x	x	x	x	x		x		
20		x	x	x	x	x	x		
K7, K11, K18, K22, K26, K31					x	x	x	x	x
28, 31, 33				x	x	x	x	x	x
24		x	x	x	x	x	x	x	x
27				x	x	x		x	x
29				x	x	x	x		
K16					x	x		x	x
32				x	x				
216–220				x					
K1, K5, K9, K14, K20, K27, K28, K34, K36, K38, K40					x				
9, 47–93, 95–102	x								
111–152		x							
94, 103	x	x							

[1] Cruises A, B, C, D, E, F, G, H, I are designated, respectively, as the following in Richardson et al., 1977: C7412B, C7501D, C7504B, C7506C, C7509E, C7510E, C7601A, C7604B, C7606A.

ited by a 32.5‰ salinity isopleth which may extend to a depth of about 40 m (Barnes et al., 1972). Salinities at 20 m or more below the surface vary little throughout the year, about 32‰ to 34‰ (Duxbury, 1972). Bottom temperatures at these depths off the Columbia River probably do not differ appreciably from those reported off central Oregon (Adriana Huyer, pers. comm.), i.e. between 6°C and 7°C to nearly 11°C (Huyer, 1977). Bottom currents off the Columbia River are discussed in Barnes et al. (1972).

Stations directly off the Columbia River and south to 46°13′N, between 124°08′W and 124°11.5′W, exhibited large seasonal variation in sediment composition (Table 2A) in concordance with seasonal variation in river flow and wave conditions. Bottom sediments within this area contained the least mud (silt + clay) during the winter, when much of it is suspended in the water column by long-period surface waves, and the most mud during the summer or fall, when high river flow and moderate wave conditions favors deposition of silts and clays (Kulm et al., 1975). Sediment types of seasonally sampled stations within the above area changed from sand to muddy sand (silty or clayey sand) or sandy silt—or in one case, clayey silt. Stations outside this area (Table 2B) did not show large temporal variations in silt + clay content. Of these, the majority were sand.

Table 2A. Sediments and Depths off the Columbia River: Stations within area characterized by large seasonal variation in silt + clay content.[1]

Station	Range of Depths[2] in meters	Percentage Silt + Clay: Winter Cruise A and/or B + sometimes G	Spring Cruise C	Summer Cruise D	Fall Cruise E	Sediment Type(s)[3]
13	18–20	3.46	14.91	45.75	39.28	Sa, SSa
14	31–33	0.99–1.39	6.27	5.16	29.87	Sa, SSa
15	42–46	1.59–5.04	21.00	63.31	23.26	Sa, SSi
16	31–37	8.59–37.06	34.20	82.94	89.18	Sa, SSa, CSi
17	31–33	14.45–24.02	26.68	32.98	78.15	Sa, SSa, CSa, SSi
22	22–33	10.82–14.01	11.69	20.77	27.40	Sa, SSa
25	15–18	1.66–1.77	3.54	28.22	38.22	Sa, SSa
26	20–29	1.34–1.65	16.10	48.09	52.37	Sa, SSa
65	49	13.18	—	—	—	Sa, —
70	51	2.48	—	—	—	Sa, —
72	26	1.25	—	—	—	Sa, —
74	35	1.42	—	—	—	Sa, —
76	37	1.42	—	—	—	Sa, —
77	27	1.16	—	—	—	Sa, —
78	22	0.95	—	—	—	Sa, —
79	20	1.21	—	—	—	Sa, —
80	20	1.02	—	—	—	Sa, —
81	18	5.35	—	—	—	Sa, —
83	18	2.75	—	—	—	Sa, —
86	26	1.16	—	—	—	Sa, —
87	40	2.57	—	—	—	Sa, —
88	44	?	—	—	—	?
89	40	16.14	—	—	—	Sa, —
92	20	5.70	—	—	—	Sa, —
93	15	2.86	—	—	—	Sa, —
94	16–17	1.62–2.54	—	—	—	Sa, —
95	47	42.76	—	—	—	SSa, —
103	24–31	5.05–10.93	—	—	—	Sa, —
117	31	1.37	—	—	—	Sa, —
118	37	1.63	—	—	—	Sa, —
119	18	3.99	—	—	—	Sa, —
126	40	17.34	—	—	—	Sa, —
129	18	2.18	—	—	—	Sa, —
131	15	2.14	—	—	—	Sa, —
132	15	2.08	—	—	—	Sa, —
133	15	1.70	—	—	—	Sa, —
134	17	1.97	—	—	—	Sa, —
135	22	4.54	—	—	—	Sa, —
136	31	16.20	—	—	—	Sa, —
137	37	28.82	—	—	—	SSa, —

[1] The area characterized by large seasonal variation in sediment composition is delineated in paragraph 2 under "Study Area."

[2] Depths are not corrected for tides or waves.

[3] Sa = sand, SSa = silty sand, CSa = clayey sand, SSi = sandy silt, CSi = clayey silt. Sediment types referred to in this paper are those of Shepard (1954).

Table 2B. Sediments and Depths off the Columbia River: Stations outside of area characterized by large seasonal variation in silt + clay content.[1]

Station	Range of Depths[2] in meters	Percentage Silt + Clay	Sediment Type(s)
1	17–20	1.24–2.84	Sand
2	29–35	1.21–1.73	Sand
3	45–53	1.68–3.16	Sand
4	66–70	3.13–6.23	Sand
5	82–88	14.49–28.33	Sand to Silty Sand
6	37–45	19.53–26.90	Sand to Silty Sand
7	55–66	22.52–42.40	Sand to Silty Sand
8	80–85	26.54–31.13	Silty Sand
9	81	23.06	Sand
10	15–17	1.12–1.23	Sand
11	11–13	1.21–5.27	Sand
12	15–16	1.73–8.13	Sand
18	40–46	1.47–12.06	Sand
19	29–31	1.25–2.03	Sand
20	22–24	0.97–5.16	Sand
21	17–20	1.32–16.91	Sand
23	27–31	10.13–29.23	Sand to Silty Sand
24	24–27	1.42–1.76	Sand
27	26–29	0.76–1.58	Sand
28	26–29	1.35–1.97	Sand
29	27–30	0.92–1.78	Sand
31	24–27	1.47–1.85	Sand
32	24	1.22–1.76	Sand
33	26–30	1.27–1.90	Sand
47	88–91	17.01	Sand
48	70	5.02	Sand
49	46	2.21	Sand
50	29	2.47	Sand
55	77	17.27	Sand
56	62	7.14	Sand
58	27	1.29	Sand
61	18	1.90	Sand
62	24	1.34	Sand
66	66	21.11	Sand
68	82	27.32	Silty Sand
69	68	15.51	Sand
96	67	21.25	Sand
97	97	31.19	Silty Sand
98	86	27.26	Silty Sand
99	68	24.25	Sand
100	48	27.07	Silty Sand
101	29	14.81	Sand
102	13	2.61	Sand
111	20	1.63	Sand
113	20	1.15	Sand
114	13	1.46	Sand
124	20	1.37	Sand
125	26	1.11	Sand
141	33	18.38	Sand
146	40	60.48	Sandy Silt
147	60	33.34	Silty Sand

Table 2B. Continued.

Station	Range of Depths[2] in meters	Percentage Silt + Clay	Sediment Type(s)
148	75	33.42	Silty Sand
149	84	39.14	Silty Sand
150	64	?	?
151	40	12.64	Sand
152	29	11.83	Sand
216	14	1.21	Sand
217	14	1.06	Sand
218	13	1.26	Sand
219	14	1.09	Sand
220	15	0.95	Sand
K1	29	1.28	Sand
K5	22	1.27	Sand
K7	22–29	1.19–1.69	Sand
K9	22	1.30	Sand
K11	22–27	1.21–1.52	Sand
K14	26	1.08	Sand
K16	25–27	0.89–1.48	Sand
K18	25–26	0.88–1.27	Sand
K20	24	1.18	Sand
K22	26–29	0.91–1.37	Sand
K26	24–27	0.97–1.59	Sand
K27	24	1.45	Sand
K28	29	1.45	Sand
K31	26–28	0.89–2.20	Sand
K34	27	1.11	Sand
K36	27	1.00	Sand
K38	27	1.42	Sand
K40	27	1.56	Sand

[1] The area characterized by large seasonal variation in sediment composition is delineated in paragraph 2 under "Study Area."
[2] Depths are not corrected for tides or waves.

In general, the silt + clay content of sediments north of the river exceeded that of sediments south of the river. Stations south of the river in less than 40–50 m (excluding those within the area of large seasonal variation in sediment composition) generally contained less than 5% silt + clay throughout the study period, the silt + clay fractions increasing further offshore. A detailed account of textural and mineralogical properties of sediments off the Columbia River is presented in Sternberg et al. (1977—a Final Report to the U.S. Army Corps of Engineers). Depths sampled in this study ranged from 11 to 97 m (see Tables 2A and 2B).

Species Accounts

Records of collected specimens are listed under the appropriate species by station and cruise. For example, three specimens collected at station 10 during cruise A would appear as 10A (3). Holotypes have been deposited in the United States National Museum. Paratypes have been deposited in the United States National Museum, the Allan Hancock Foundation, Oregon State University, and the Virginia Institute of Marine Science. Representative specimen(s) of every

species reported herein (except *Paranaitis polynoides* and *Eulalia levicornuta*) have been deposited in the Allan Hancock Foundation.

Genus *Eteone* Savigny, 1818

Eteone fauchaldi, new species

(Fig. 2A–G)

Records.—2E (1); 3G (1); 6B (1), C (2), G (1); 12D (1); 13A (1); 14G (1); 16C (1), G (2); 17C (1); 18E (1); 19E (1, TYPE); 22C (1); 23E (1); 28F (1), H (1); 31H (1); 33E (1); 101A (1); 117B (1); 146B (1); K14E (1); K18E (1); K34E (2); K36E (1); K40E (1).

Description.—Length to 62 mm; width 0.5 to 1.9 mm; number of segments to 238. Prostomium long, trapezoidal with rounded anterior part having 2 pairs of slender, subulate antennae, the anterior pair slightly shorter (Fig. 2A). 2 widely set black eyes located slightly anterior to the small nuchal papilla at the posterior margin of prostomium.

First segment about 1½–2¼ times as long as segment 2, provided laterally with 2 pairs of tentacular cirri, similar in shape to the prostomial antennae. Ventral pair 1¼–1½ times as long as dorsal pair. Segment 2 with small setigerous lobe. Setae on segment 2 absent in the largest specimens (39 mm and longer), well developed in a juvenile (2.5 mm), and poorly developed in other specimens.

Dorsal cirri conspicuous, slightly asymmetrical, their posterior surfaces somewhat concave. Ventral cirri broad. Both dorsal and ventral cirri surpass acicular lobes throughout the body; the ventral cirri are shorter than dorsal cirri. Presetal lip of neuropodia exceeds postsetal one. Large acicula reaches or surpasses presetal lip. Length-width ratio of dorsal cirri in anterior and median segments varies with size of animal (Figs. 2B, 2E and 2G) and increases posteriorly in all specimens. In a large specimen the dorsal cirri are rounded and broader than long anteriorly at segment 24 (Fig. 2B), as long as wide at about segment 60 (Fig. 2C), broadly conical by segment 90 (Fig. 2D), and somewhat longer posteriorly. Anterior dorsal cirri of holotype (22 mm) nearly as long as wide (Fig. 2E), gradually becoming longer than wide posteriorly (Fig. 2F). Anterior dorsal cirri of younger specimens may be longer than wide (Fig. 2G). Setae with shafts ending in 2 very unequal prongs, these with associated spines. Appendage finely denticulated on concave edge.

Proboscis, when dissected, is tuberculate. Anal cirri long, tapering.

Color is whitish in alcohol.

It is our pleasure to name this species after Dr. Kristian Fauchald, who gave us so much of his time during our visits to the Allan Hancock Foundation.

Remarks.—As noted in the above description, setae on segment 2 are absent in the largest specimens, well developed in a juvenile, and poorly developed in other specimens. Thus, the setae on this segment may be lost with growth. Eliason (1962, *fide* Ushakov, 1972) observed a similar phenomenon in specimens of *Eteone lactea* Claparede from the Oresund.

Systematic discussion.—*Eteone fauchaldi* is not likely to be confused with any other Pacific species but it bears considerable resemblance to *E. heteropoda* Hartman, found in the Northwest Atlantic Ocean and the Gulf of Mexico. A comparison of the two species reveals the anterior ends (including the tentacular cirri) and posterior ends to be similar but the structure of the dorsal cirri to differ.

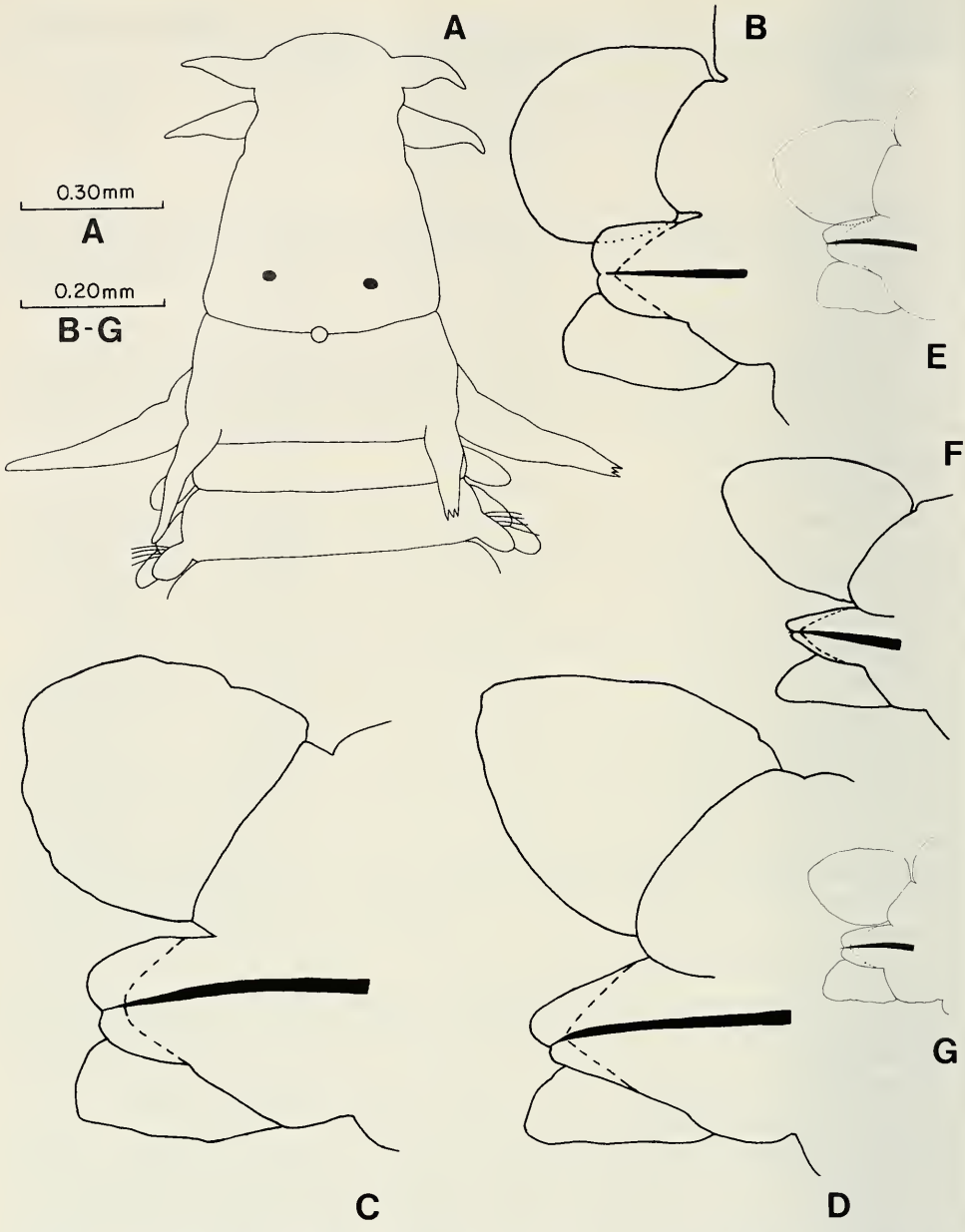

Fig. 2. A–G, *Eteone fauchaldi* new species. A, anterior end of a large specimen, dorsal view, ×100. B–D, from 39 mm specimen: B, parapodium from segment 24, anterior view, ×125; C, parapodium from segment 59, anterior view, ×125; D, parapodium from segment 90, anterior view, ×125. E–F, from holotype, approximately 22 mm: E, parapodium from segment 20, anterior view, ×500; F, parapodium from segment 92, anterior view, ×125. G (10 mm specimen), parapodium from segment 18, anterior view, ×500.

In *E. heteropoda* the middle and posterior dorsal cirri are distinctly asymmetrical, but in *E. fauchaldi* the dorsal cirri are only slightly asymmetrical.

Distribution.—Oregon to Washington in 15–50 m on sand, silty sand, and sandy silt (1).

Eteone longa (Fabricius, 1780)

Nereis longa Fabricius, 1780.
Eteone longa Pettibone, 1954; Berkeley and Berkeley, 1948; Banse and Hobson, 1974.

Records.—1D (1), E (5), G (1); 2E (3), G (6); 3E (2); 4E (1); 10E (1), G (1); 19E (1), G (1); 20G (1); 24F (2), G (1), H (6), I (2); 28E (2), F (3), G (1), H (8), I (2); 29E (3), F (1), G (1); 31E (3), F (5), G (2), H (3); 32E (1); 33E (2), F (2), H (1), I (2); K1E (2); K5E (1); K7E (2), F (2); K11E (2), F (1), G (1); K14E (2); K16E (1), H (1); K18E (1); K26E (2), F (2); K27E (2); K28E (2); K31E (1); K34E (1); K40E (1).

Pettibone (1954) synonymized *Eteone californica* Hartman, described from California, with *E. longa*. We consider the two as distinct species and have found both in the present study (see *E. californica* below). *E. longa* has dorsal cirri which are longer than wide, bluntly conical, but *E. californica* has broadly rounded dorsal cirri that are as wide as long. Specimens from Arctic Alaska and Washington identified as *E. longa* by Pettibone, 1954, were not examined by us, but the parapodium illustrated in that publication agrees with those of the present specimens.

In the Northeast Pacific Ocean, *E. longa* is previously known from British Columbia and Washington. The present records extend the distribution southward to northern Oregon.

Local distribution.—Off Oregon in 16–51 m on sand with less than 5% silt + clay. (One in 66 m on sand with 5.58% silt + clay.)

Eteone californica Hartman, 1936

Eteone californica Hartman, 1936, 1968.

Records.—2E (1); 3D (1), E (10); 4A (1), D (1), E (12), G (3); 5D (1), E (5), G (2); 6B (2), D (3), E (2), G (1); 7B (5), C (5), D (1), E (8), G (4); 8B (1), C (1), D (1), G (3); 9A (4); 13E (1); 16C (3); 18E (3); 19E (1); 20E (1); 28F (1); 48A (1); 55A (2); 56A (1); 65A (14); 66A (1); 69A (3); 70A (4); 96A (4); 98A (1); 99A (4); 100A (2); 147B (2); 148B (2); 149B (1); 150B (2).

Eteone californica differs from *E. longa* in having dorsal cirri as wide as long, broadly rounded, instead of longer than wide, bluntly conical.

These records are the first obtained off the coast of Washington and Oregon, but the species has been recorded both to the north and south.

Local distribution.—Oregon to Washington in 18–88 m on sand and silty sand.

Eteone spilotus, new species
(Fig. 3A–C)

Records.—5E (2), G (1); 7B (1), C (6), D (2), E (11), G (3); 8C (1), E (3), G (4); 15A (1); 16A (7); 22A (2); 65A (24); 88A (32, TYPE); 89A (2); 95A (1); 96A (1); 99A (1); 100A (8); 148B (2); 150B (1).

Description.—Length to over 26 mm; width 0.3 to 1.1 mm; number of segments to over 100. Prostomium slightly longer than wide, rounded anterior portion with 4 subequal antennae (Fig. 3A). 2 black eyes near posterior margin; a small nuchal papilla at postmedian margin.

Segment 1 about 1½ times as long as segment 2, with 2 pairs of subequal tentacular cirri longer than prostomial antennae. Segment 2 with setigerous lobes and setae well developed.

Parapodia with small dorsal and ventral cirri (Figs. 3B and 3C). Symmetrical dorsal cirri inflated and subquadrangular, about as long as broad, somewhat longer posteriorly. They reach or slightly surpass the acicular lobes throughout the body. In median and posterior segments neuropodial lips are subequal and elongated, ventral cirri reach to about middle of the acicular lobes (Figs. 3B and 3C). Setae with shafts ending in 2 equal prongs and numerous small spines. Appendage finely denticulated on concave edge.

Proboscis smooth when everted. Anal cirri 2, thick, twice as long as broad.

Color in alcohol pale, with distinct patches of black or brown pigment spots on dorsum of each segment—one patch at each side at base of parapodia, vaguely connected by a narrow transverse band; a smaller, medial patch anterior to transverse one on some segments. Pattern duplicated on ventrum. Dorsal cirri and some ventral cirri darkly pigmented.

Etymology.—The specific name is derived from the Greek *spilotos,* meaning spotted, in reference to the distinct patches of pigment spots on the body.

Systematic discussion.—*Eteone spilotus* differs from *E. californica* Hartman in body coloration and in having ventral cirri distinctly shorter than the acicular lobes.

Distribution.—Oregon to Washington in 33–88 m on silty sand and sand with greater than 10% silt + clay. (One on sand with 1.59% silt + clay.)

Eteone columbiensis, new species
(Fig. 3D–G)

Records.—11E (2); 21C (4), D (31, TYPE); 25D (1); 111B (8); 216D (2); 217D (2).

Description.—Length about 34 mm; width 0.4 to 1 mm; number of segments to over 150. Anterior region of body dilated through 15 to 20 segments. Prostomium elongate and abruptly tapered such that its broad posterior portion comprises about half the total length, sometimes less (Fig. 3D). Anterior margin of prostomium one third as wide as posterior margin, with 2 pairs of slender, subulate, subequal antennae. 2 black eyes in posterior part of prostomium, a small nuchal papilla at the posterior margin.

Segment 1 slightly longer than segment 2, with 2 pairs of tentacular cirri, dorsal pair shorter; both pairs slightly shorter than prostomial antennae. Segment 2 with setigerous lobes and setae well developed.

Dorsal cirri are symmetrical, subrectangular and inflated, very small in anterior setigers (Fig. 3E). They are larger and surpass the acicular lobes from setiger 10–20 through the mid-region (Fig. 3F), becoming smaller posteriorly (Fig. 3G). Pre- and postsetal lips of neuropodia subequal. Ventral cirri small, same length as acicular lobes in anterior region of body. Proceeding posteriorly acicular lobes become narrow, surpassing ventral cirri (Figs. 3F and 3G). Setae in median and

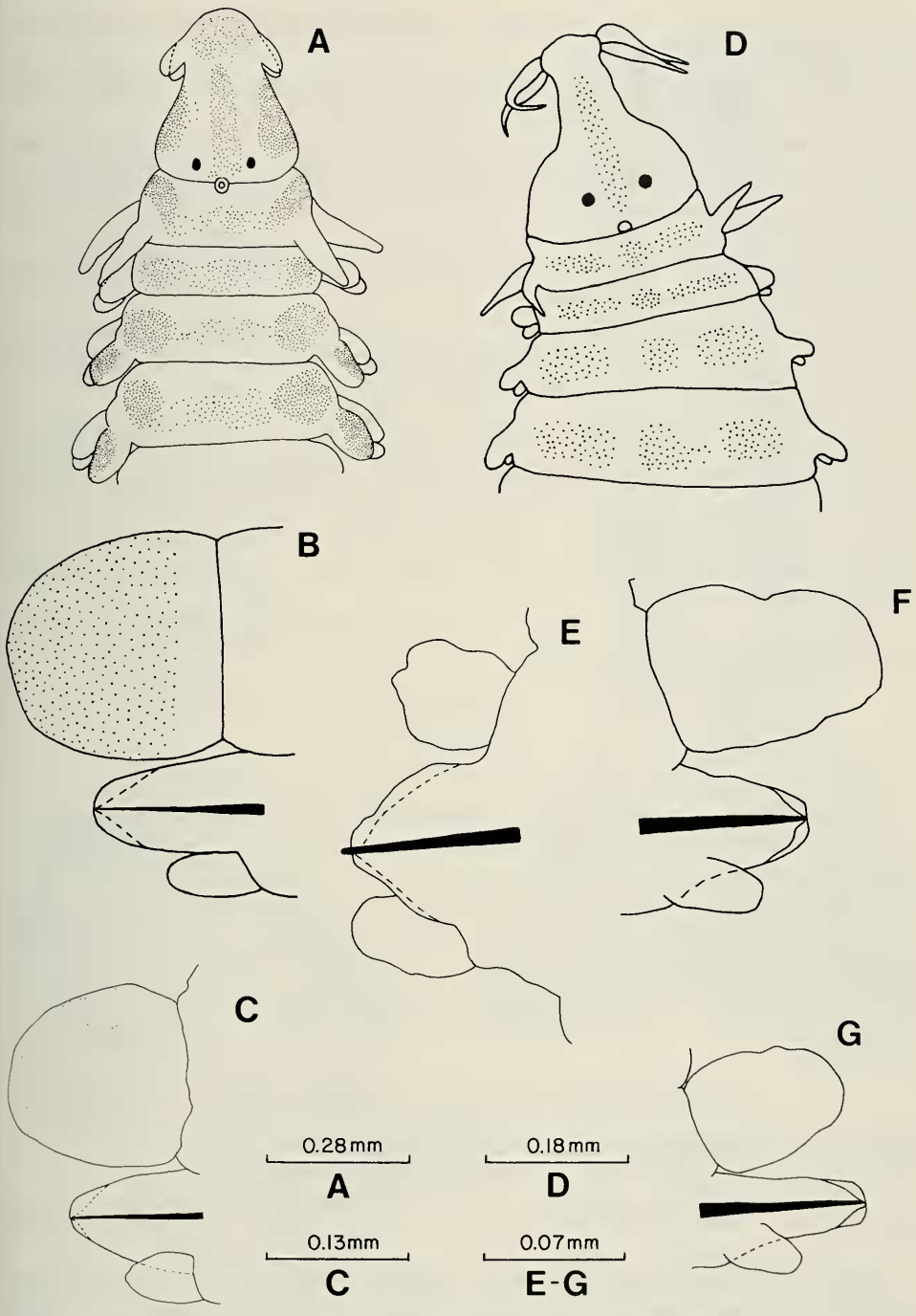

Fig. 3. A–C, *Eteone spilotus* new species. A, anterior end, dorsal view, ×125. B–C, from a 20 mm specimen: B, parapodium from segment 33, anterior view (diagram); C, parapodium from segment 71, anterior view, ×500. D–G, *Eteone columbiensis* new species. D, anterior end, dorsal view, ×100. E, parapodium from segment 7, anterior view, ×500. F, a median parapodium, posterior view, ×500. G, a posterior parapodium, posterior view, ×500.

posterior segments with shaft endings of equal length. Appendage finely denticulated on concave edge.

Proboscis smooth proximally; distal half with many small soft papillae. Anal cirri 2, thick, slightly clavate, twice as long as broad.

Color in alcohol pale green, with 3 distinct patches of dark green or brown pigment spots on dorsum of each segment—one patch at each side at base of parapodia and one medial. Pattern duplicated on ventrum. Dorsal cirri occasionally pigmented.

Etymology.—The specific name alludes to the Columbia River, in which region the present species was collected.

Remarks.—Four gravid individuals were collected at station 21, two in April 1975 (21C) and two in June 1975 (21D). The eggs are observed in the parapodial bases and give the egg-containing segments a light orange color.

Systematic discussion.—*Eteone columbiensis* appears to be closely related to *E. dilatae* Hartman, but differs from it in the shape of the prostomium and the body coloration. The prostomium of *E. dilatae* tapers gradually from the posterior to anterior margin, while that of *E. columbiensis* is abruptly tapered. *Eteone dilatae* is pale greenish yellow, while *E. columbiensis* is pale green with three distinct patches of dark green or brown pigment spots on dorsum and ventrum of each segment.

Distribution.—Within the mouth of the Columbia River to directly offshore in 11–20 m on sand, and silty sand (1).

Eteone sp.
(Fig. 4A–B)

Records.—4D (1), E (1); 5G (1); 6E (1); 18E (1); 31E (1); K40E (1).

These specimens, which belong to a single species, resemble *Eteone spetsbergensis* Malmgren in the form of the dorsal cirri. Dorsal cirri are asymmetrical and their length-width ratio in median segments can vary between individuals (compare Figs. 4A and 4B from two different specimens). Prostomium is about as long as wide. Setae on segment 2 are well developed. Ushakov (1972) and Pettibone (1954, p. 233) reported *E. spetsbergensis* as having setae poorly developed or absent on segment 2. Identification is uncertain at the present time.

Local distribution.—Off Washington in 44 m on sand (1); off Oregon in 26–82 m on sand.

Eteone (*Mysta*) *barbata* (Malmgren, 1865)

Mysta barbata Malmgren, 1865; Bergstrom, 1914.
Eteone (*Mysta*) *barbata* Ushakov, 1972; Pettibone, 1954.

Records.—4E (1); 6C (1), D (1); 14D (1); 15D (1); 16G (1); 17B (1), D (2); 22D (1).

Small individuals (about 9 mm) differ from large specimens in having a brown longitudinal stripe down each side of the dorsum. Also, the dorsal cirri of the small specimens have a greater length-width ratio, about 1 in posterior segments.

The present records are the first in the Northeast Pacific Ocean. Previously known in the Pacific only on the Asiatic coast, to the sea of Japan.

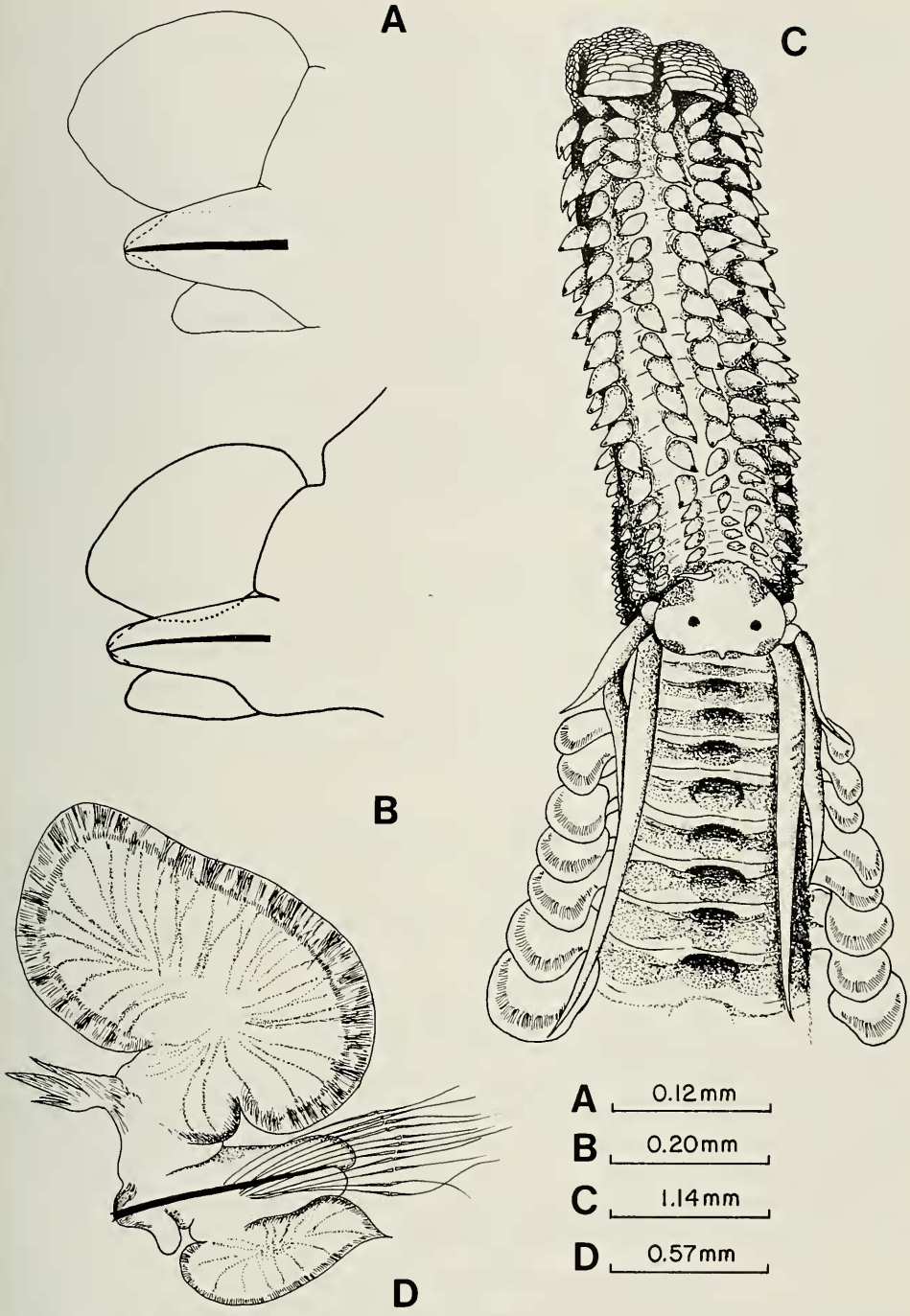

Fig. 4. A–B, *Eteone* sp. A–B, median parapodia from two different specimens. C–D, *Anaitides multipapillata* new species. C (holotype), anterior end and proboscis, dorsal view. D, 40th parapodium.

Local distribution.—Northern Oregon to Washington in 26–66 m on sand (with greater than 5% silt + clay), clayey sand (1), and sandy silt (1).

Genus *Anaitides* Czerniavsky, 1882

Anaitides multipapillata, new species

(Fig. 4C–D)

Records.—3D (1), G (1); 12E (2); 14C (1); 15D (1), G (1); 16D (1), G (1); 17B (1), D (1), E (1), G (1); 19D (1); 20D (1); 24I (1); 25E (1); 27H (1); 33G (1); 66A (1); 103B (1); 126B (1, TYPE); K31E (1); K40E (1).

Description.—Length to 95 mm; width excluding parapodia to 5 mm; number of segments to 200. Cephalic lobe subcordate with 2 dark circular eyes, a postmedian incision with a small occipital papilla, and a pair of small retractile nuchal processes at posterior margin of the cephalic lobe near base of first pair of tentacular cirri (Fig. 4C). Longest of four pairs of tentacular cirri drawn posteriorly reaches to segment 10–16. In preserved specimens, dorsum with dark iridescent transverse bars of olive green pigment, ventrum lighter, often whitish. Dorsal cirri usually olive green with a pale to white margin (Fig. 4D). Some preserved specimens are gray.

Prostomium with 4 antennae and pigmented in two triangular, olive green patches (Fig. 4C). Distal part of proboscis tuberculate with tubercles arranged in six rows. Proximal portion of proboscis with 12 evenly spaced rows of 20–24 papillae per row (Fig. 4C). Papillae large and turgid, often with red pigmented tips. Setae from third segment. Formula of anterior segments: $\left(1 + 0\frac{1}{1} + S\frac{1}{N}\right)$, with dorsal tentacular cirri on second segment the longest. Setae are homogomph compound spinigers, appendage finely denticulated along one edge, shaft distally spinous.

Dorsal cirri large, subquadrangular, covering about ¼ of the dorsum. Ventral cirri distally pointed, extending beyond setal lobes (Fig. 4D). Pygidium blunt. Anal cirri 2, cylindrical, tapering, about twice as long as width of pygidium.

Etymology.—The specific name derives from the numerous papillae per row on the proboscis.

Systematic discussion.—*Anaitides multipapillata* is distinguishable from *A. groenlandica* (Oersted) and *A. mucosa* (Oersted) by the absence of a distinct dorsal and ventral separation in the rows of proboscideal papillae and by the large size of these papillae. The papillae are more numerous than in *A. mucosa*. However, large specimens of *A. groenlandica* may have about the same number of papillae per row as *A. multipapillata*. Identification of *A. multipapillata* requires examination of proboscis.

Distribution.—South of Columbia River to directly off mouth in 15–66 m on sand, silty sand (1), clayey sand (1), sandy silt (2), and clayey silt (1).

Anaitides groenlandica (Oersted, 1843)

Phyllodoce (*Anaitides*) *groenlandica* Ushakov, 1972; Pettibone, 1954, 1963; Berkeley and Berkeley, 1948.

Records.—2D (1); 3E (2), G (1); 4D (3), E (3), G (3); 5D (2), E (1); 7B (1), D (4), E (1); 8B (2), C (1), D (5), E (6), G (2); 9A (4); 25E (2); 29D (1); 31E (1), G

(1); 47A (2); 56A (1); 65A (6); 68A (1); 69A (2); 70A (7); 89A (1); 95A (5); 98A (1); 137B (1); 147B (3); 149B (1); 150B (1); K7E (1).

The shape of the ventral cirri in our specimens varied from small to large animals. Small specimens had pointed ventral cirri as described for *Anaitides mucosa* (Oersted); large specimens had ventral cirri as described for *A. groenlandica*, i.e. oval with asymmetrical acuminate tip; intermediate sized specimens had ventral cirri intermediate in shape between *A. groenlandica* and *A. mucosa*. *Anaitides groenlandica* reportedly has a greater number of papillae per row on the proboscis than *A. mucosa*, 12–15 vs. 8–10 (Ushakov, 1972); 10–20 vs. 8–12 (Pettibone, 1963); greater than 12 vs. not more than 10 (Banse and Hobson, 1974), and their color patterns differ (see respective descriptions in Ushakov, 1972). In our material, the larger specimens among those with *groenlandica* type ventral cirri had greater than 12 papillae per row on the proboscis and a color pattern as described for *A. groenlandica*, brown, with dark brown transverse stripes on dorsum; dorsal cirri brown with pale margins, thus fitting the definition of this species completely. All remaining specimens, those with *groenlandica* type ventral cirri, those with *mucosa* type ventral cirri, and those with intermediate shaped ventral cirri, had 12 papillae per row on the proboscis and the same color pattern described above. We therefore conclude that all our specimens belong to *A. groenlandica*; those with *mucosa* type ventral cirri are merely juvenile *A. groenlandica*. The largest specimen (6 mm wide) had about 25 papillae per row on the proboscis. As far as we know, no workers to date have reported greater than 20 papillae per row in specimens of *A. groenlandica*.

Local distribution.—Oregon to Washington in 15–88 m on sand and silty sand.

Anaitides hartmanae (Blake and Walton, 1977)

Phyllodoce hartmanae Blake and Walton, 1977.

Records.—2G (1); 3G (1); 6E (1); 7C (2), D (4), E (1), G (2); 8C (1), G (1); 14A (1); 18B (1); 19E (1); 24H (3); 28E (1), G (1); 29G (1); 31G (1); 33D (1), E (1); 97A (1); 147B (1); K1E (1); K28E (1); K34E (1); K36E (1).

The present species is herein referred to the genus *Anaitides* Czerniavsky, rather than *Phyllodoce* Savigny, because the papillae on the basal half of the proboscis are arranged in rows; see Fauchald (1977), p. 48. The rows of papillae are oblique (spirally arranged, according to Blake and Walton, 1977).

Anaitides hartmanae is previously known only from California where it was described. The present records extend the distribution northward to Oregon and Washington.

Local distribution.—Oregon to Washington in 26–97 m on sand and silty sand.

Anaitides longipes (Kinberg, 1866)

Phyllodoce (*Anaitides*) *longipes* Kinberg, 1866.
Anaitides longipes Hartman, 1968.

Records.—3D (1); 8B (1); 15D (1); 18D (1).

In the Pacific Ocean, *Anaitides longipes* is previously known from Chile and California. The present records extend the distribution northward to Oregon and Washington.

Local distribution.—Off Washington in 80 m on silty sand (1); off Oregon in 44–53 m on sand and sandy silt.

Genus *Paranaitis* Southern, 1914
Paranaitis polynoides (Moore, 1909)

Anaitis polynoides Moore, 1909.
Paranaitis polynoides Hartman and Reish, 1950; Hartman, 1968; Ushakov, 1972.
Phyllodoce (Paranaitis) polynoides Berkeley and Berkeley, 1948.

Records.—4E (1); 147B (1).

Local distribution.—Off Washington in 60 m on silty sand (1); off Oregon in 66 m on sand (1).

Genus *Eulalia* Savigny, 1818
Eulalia levicornuta Moore, 1909

Eulalia levicornuta Moore, 1909; Hartman, 1968.
Eulalia (Eulalia) levicornuta Banse and Hobson, 1968.

Records.—5C (1), D (1).

These records are the first off Oregon, but the species has been recorded both to the north and south.

Local distribution.—Off Oregon in 86–88 m on sand with greater than 15% silt + clay. (Note that both specimens were collected at the same station but during different cruises.)

Genus *Eumida* Malmgren, 1865
Eumida sanguinea (Oersted, 1843)

Eulalia sanguinea Oersted, 1843.
Eumida sanguinea Hartman and Reish, 1950; Hartman, 1968; Ushakov, 1972.
Eulalia (Eumida) sanguinea Berkeley and Berkeley, 1948.

Records.—4E (1); 5C (1); 7D (1), E (1); 8B (2), D (1); 47A (1); 48A (2); 55A (2); 68A (2); 69A (2); 97A (1); 148B (1).

Local distribution.—Oregon to Washington in 55–97 m on sand (with greater than 5% silt + clay) and silty sand.

Distributional Patterns Within the Genera *Eteone* and *Anaitides*

The local distribution, including depths and sediment type(s), for each phyllodocid species is given in the previous section. Seven species of *Eteone* occurred in the study area. *Eteone columbiensis* occurred only in shallow water (11–20 m) within and directly off the mouth of the Columbia River, in sand and silty sand. *Eteone longa* was restricted to sediments with less than 5% silt + clay and occurred only in 16–51 m off Oregon (except one specimen referred to under "local distribution" in the previous section), south of the area characterized by large seasonal variation in sediment composition.[1] *Eteone spilotus* occurred in sand with greater than 10% silt + clay and silty sand from Oregon to Washington (except one specimen referred to under "distribution" in the previous section).

[1] The area characterized by large seasonal variation in sediment composition is delineated (and discussed) in paragraph 2 under "Study Area."

The distributions of the above three species did not overlap one another; that of *E. columbiensis* did not overlap any other species of *Eteone*. *Eteone californica*, *E. fauchaldi*, *E. barbata*, and *E.* sp. each had a distribution which overlapped that of every species of *Eteone* except *E. columbiensis*. The first three occurred in sand and muddier (greater than 25% silt + clay) sediments from Oregon to Washington. *Eteone* sp. occurred off Washington and Oregon in sand.

Each of the four species of *Anaitides* in the study area occurred in sand as well as muddier (greater than 25% silt + clay) sediments and their distributions overlapped one another. *Anaitides groenlandica* occurred off Oregon, Washington, and directly off the Columbia River. *Anaitides multipapillata* occurred south of the Columbia River and directly off it. *Anaitides hartmanae* occurred off Washington (21 specimens) and Oregon (18 specimens), but only one specimen (station 97A) was collected directly off the Columbia River, in deep water (97 m). In contrast to *A. groenlandica* and *A. multipapillata*, only one specimen of *A. hartmanae* (station 14A off Oregon) was found within the area characterized by large seasonal variation in sediment composition resulting from seasonal differences in river flow and wave intensity.[1] Though the latter species occurred in sediments ranging from 1% silt + clay to 42% silt + clay, perhaps it is less tolerant than the other two species to the temporal fluctuations in habitat within the above area. Only four specimens of *A. longipes* were collected, three off Oregon and one off Washington.

Members of the family Phyllodocidae occurred commonly but in low numbers. Species were represented by only one or two individuals in the majority of replicate sets in which they occurred. For this reason, it is impossible to detect seasonality in the abundance of the phyllodocid species, even within the area characterized by large seasonal variation in sediment composition.

One species which exhibited a temporal change in occurrence is *Eteone longa*. This species occurred commonly within and adjacent to the rectangular area delineated in Fig. 1 from cruise E (September 1975) to cruise I (June 1976), but only one specimen was collected prior to cruise E. (Considering *E. longa*-containing stations sampled both before cruise E and from cruise E onward, the species occurred in 1 of 33 replicate sets taken before cruise E, and in 32 of 39 replicate sets taken between cruise E and I.) In July and August 1975, between cruises D and E, the U.S. Army Corps of Engineers dumped approximately 460,000 m^3 of dredge material in the area delineated by the rectangle in Fig. 1 (Richardson et al., 1977; this area is referred to as experimental site G in that publication). Prior to disposal, the median diameter of sediment in this area ranged from 2.70 to 2.89 ϕ. As the dredge material, derived from the mouth of the Columbia River, had a high percentage of 2.0–2.5 ϕ size particles, the sediment within the rectangular area following disposal was a coarser sand, the median diameter of most stations between 2.1 and 2.4 ϕ. *Eteone longa* appeared at this time (i.e. following disposal) outside the rectangular area, in sediments not affected by dumping, most of these finer grained (median diameter greater than 2.7 ϕ), as well as within the rectangular area, in finer sediments, and coarser ones (median diameter = 2.1–2.4 ϕ) resulting from dumping. As *E. longa* did not show any preference for the coarser sediments, its sudden appearance in this general area is probably not due to the increase in sediment grain-size. Though it is tempting to postulate that *E. longa* was transported to the disposal vicinity from

the mouth of the Columbia River during dredging and dumping operations, the species was never collected at the stations within or just outside the mouth. We are unable to explain the temporal disparity in the occurrence of *E. longa*.

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